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The Impact of Intrauterine Hyperglycemia on the High Prevalence of Type 2 Diabetes and Pre-Diabetes in Adult Offspring of Women With Type 1 Diabetes or Gestational Diabetes Mellitus

Previous studies in an animal model demonstrated that intrauterine hyperglycemia is associated with increased risks of abnormal glucose tolerance, insulin resistance, development of diabetes, and abnormal fetal growth. The long-term impact of intrauterine hyperglycemia and future risk of type 2 diabetes in human offspring, however, remains to be determined. In the present study, Clausen and colleagues aimed to evaluate the roles of intrauterine hyperglycemia and genetic predisposition in the prevalence of type 2 diabetes and pre-diabetes in young adult offspring of women with either gestational diabetes mellitus (GDM) or type 1 diabetes.

A total of 597 adult offspring subjects, primarily Caucasians aged 18 to 27 years, were included in the study. Their fasting glucose levels and glucose tolerance status following a 2-hour 75-g oral glucose tolerance test (OGTT) were evaluated. The participants were divided into 4 groups according to maternal glucose metabolism during pregnancy and genetic predisposition to type 2 diabetes: offspring of women with diet-treated GDM, offspring of women who were genetically predisposed to type 2 diabetes but with a normal OGTT during pregnancy (ie, no GDM), offspring of women with type 1 diabetes, and offspring of women from the background population (low risk for type 2 diabetes and no GDM). Primary outcome was prevalence of either type 2 diabetes or pre-diabetes in the offspring.

Clausen and associates showed that the prevalence of type 2 diabetes and pre-diabetes was significantly increased among adult offspring born to mothers with hyperglycemia during pregnancy. The prevalence of type 2 diabetes/pre-diabetes in the 4 groups was 21%, 12%, 11%, and 4% in the respective groups. Offspring of mothers with GDM had the highest fasting and 2-hour plasma glucose levels. Moreover, offspring of women who had GDM or type 1 diabetes or who were at risk during pregnancy for type 2 diabetes had significantly higher body mass indices than offspring of women in the background population.

In multiple logistic regression analysis, the odd ratios (ORs) for

type 2 diabetes/pre-diabetes, after adjustment for maternal family history of diabetes, maternal overweight, and offspring age, were OR 7.76 (95% confidence interval [CI], 2.58 to 23.39) in GDM offspring and OR 4.02 (95% CI, 1.31 to 12.33) in type 1 offspring compared with offspring of the background population. In type 1 offspring, the risk of type 2 diabetes/pre-diabetes was significantly associated with elevated maternal blood glucose in late pregnancy, with OR 1.41 (95% CI, 1.04 to 1.91) per mmol/L. Additional adjustment for offspring overweight did not change the pattern. Moreover, maternal age at delivery, ethnicity, sex, and paternal diabetes status appeared to have no effect on offspring risk of type 2 diabetes.

These findings support the hypothesis that a hyperglycemic intrauterine environment plays an important role in the pathogenesis of type 2 diabetes/pre-diabetes in adult offspring of high-risk populations. Setting a goal of a normoglycemic intrauterine environment in pregnant women may reduce the risk of type 2 diabetes in future generations.

“This article is an abstract of the article: Clausen TD et al. High prevalence of type 2 diabetes and pre-diabetes in adult offspring of women with gestational diabetes mellitus or type 1 diabetes: the role of intrauterine hyperglycemia. Diabetes Care. 2008;31(2):340-346. The abstract was first published in Volume 11, Number 3 of Clinical Insights® in Diabetes, published by Professional Postgraduate Services as a part of its National Diabetes Educational Initiative (NDEI). Reprinted with permission. All rights reserved ©Professional Postgraduate Services.”

FIGURE 1: PHYSICIAN OFFICES PARTICIPATING IN THE DIABETES QUALITY CARE MONITORING SYSTEM (DQCMS) PROJECT, October 2008 (N = 49)

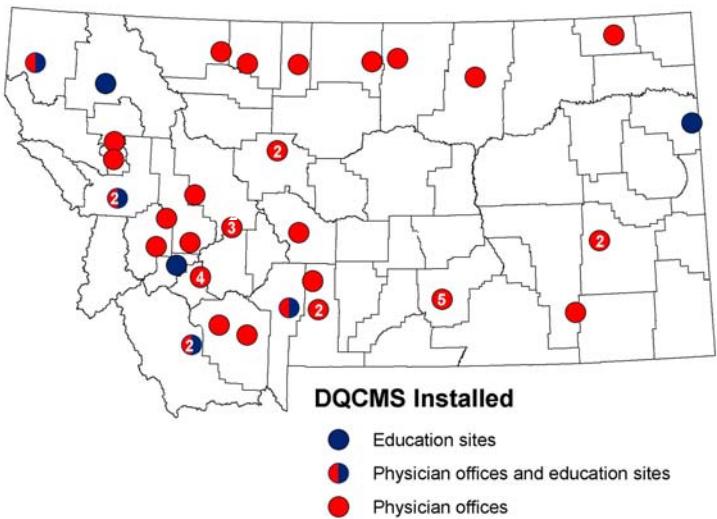


FIGURE 2: DIABETES CARE INDICATORS FROM MONTANA PHYSICIAN OFFICES PARTICIPATING IN THE DCMS/ DQCMS PROJECT, BASELINE (N = 22 CLINICS; 3,629 PATIENTS) AND OCTOBER 2008 (N = 31 CLINICS; 4,457 PATIENTS)

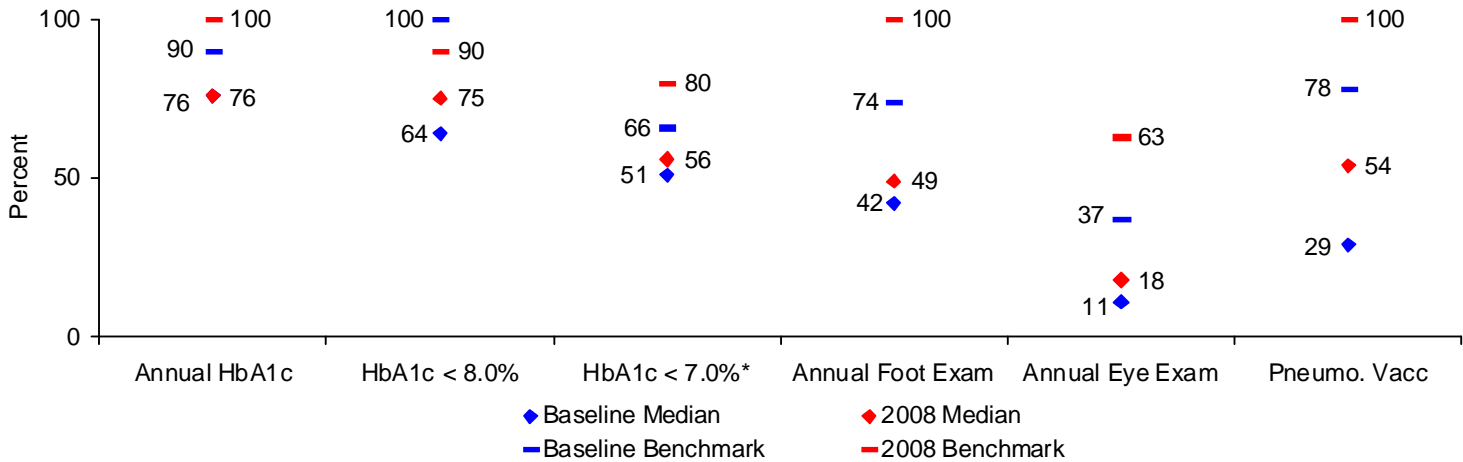
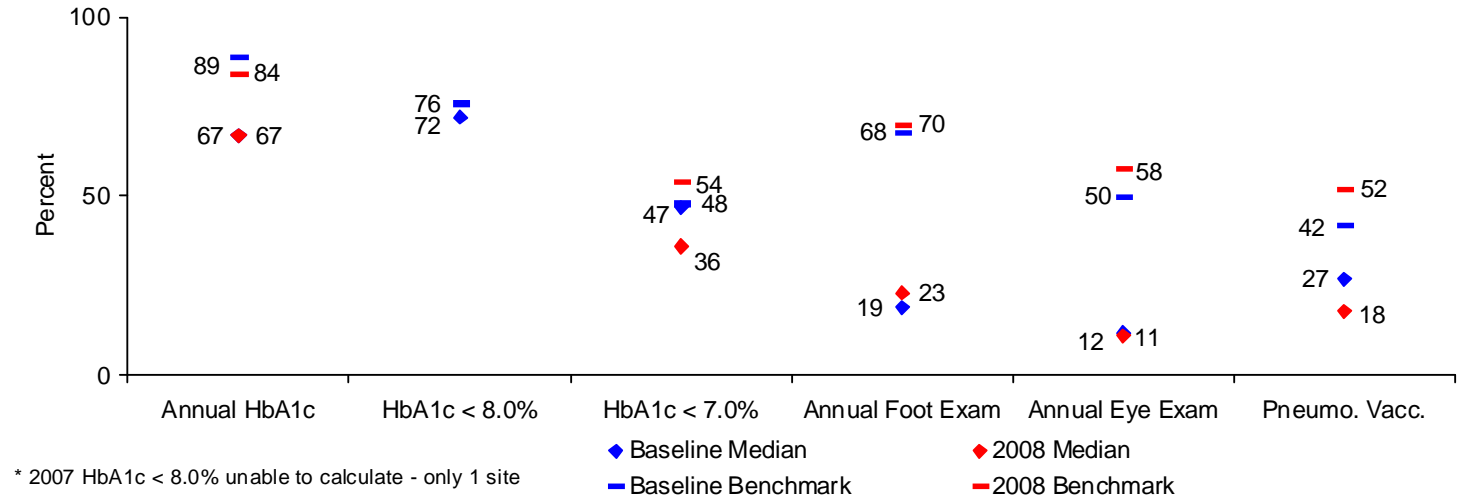


FIGURE 3: DIABETES CARE INDICATORS FROM MONTANA DIABETES EDUCATION PROGRAMS PARTICIPATING IN THE DQCMS PROJECT, BASELINE (N = 4 SITES; 912 PATIENTS) AND JULY 2008 (N = 6 SITES; 1,305 PATIENTS)



Using a Clinical Information System and Diabetes Registry in a Diabetes Care QI Program

Billings Clinic is a multi-specialty clinic based in Billings, Montana with branch clinics located in 3 other Montana cities, 1 in Wyoming, 14 outreach clinics in Montana, one in Williston, North Dakota, and eight in northern Wyoming. In 2003 their organization placed enhancing care to their diabetes population as a top priority. This has led to the implementation of a comprehensive diabetes quality improvement program.

One of the first steps in their process was to implement a diabetes data tracking system that would retrieve information in a meaningful way. They investigated the diabetes report writing capabilities of their clinical information system and found that it had limited report writing capabilities. After investigating report writing programs and not finding one that would meet their needs, they decided to look at DQCMS (Diabetes Quality Care Monitoring System) and found that it was the most flexible and comprehensive system available, and would be provided to them at no cost. The next step was to build a bridge between their clinical information system and DQCMS. This step required investing dollars and has taken 2.5 years (mainly due to their lack of programming resources). After their process was complete, staff members from the Montana Diabetes Project performed representative audits to validate that the information was being transferred to DQCMS accurately. After correction of the few issues identified, MDP did a repeat audit and validated accurate data transfer. Once a month their diabetes data is now “dumped” from their clinical information system into DQCMS.

Their diabetes registry goals are:

- Improve quality of diabetes care provided by our health system:
 - “Point of Service” reports- collate info at time of patient visit
 - Disease management of population
 - Process improvement around problem areas
- Involve the entire office staff to care for the DM pts. Automate as much as possible
- Getting ready for “pay for performance” and “public reporting” of data
- Set targets for each measure

Their plan for improvement includes specific processes to effect the improvements they have targeted and include:

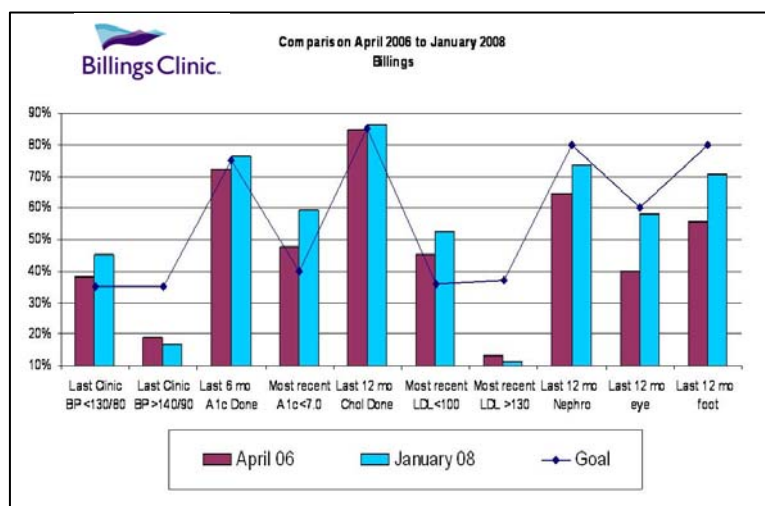
- Patients with diabetes on the provider’s daily office schedule are identified prior to the appt.
- When patients are roomed by the nurse, vitals taken & entered.
- The Provider Flowsheet is to be printed - nurse looks for deficiencies:
 - If eye exam is not documented, ask when & where and fax form to the eye provider
 - If foot exam not documented, ask patient to remove shoes and socks and remind provider to do exam.
 - If labs, immunizations needed, aspirin etc., circle on the flowsheet for provider

Once Flowsheet is prepared, place on front of chart along with a copy of the patient “report card”.

- Provider/ nurse teams can customize the process.
- Nurse/provider does foot exams.
- Nurse orders lab tests if due, gives immunizations if due, etc.
- Nurse gives patient copy of report card before patient sees provider (and reviews, if time) (Quick, easy data form for patients with education points).
- Have a site specific “diabetes panel” of labs- A1c, Lipid, CMP, Microalbumin/creatinine ratio.

The Billings Clinic has also developed a quarterly focused education program for all patients seen at their facilities for diabetes. Examples of their patient education materials can be viewed at <http://www.billingsclinic.com/body.cfm?id=447> near the bottom of the page.

The Montana Diabetes Project would like to thank the staff of Billings Clinic for sharing their diabetes care improvement process and for making improvements in the quality of diabetes care a priority for their diabetes patient population.



Save the Date!

WHAT: Heart Smart – Heart Healthy VIII
“Making the Connection”

WHEN: February 5 & 6, 2009

WHERE: Holiday Inn, Cody Wyoming

(For more information contact Dian True
dtrue.codyclinic@billingsclinic.org or call 307-527-1947)

WHAT: 2008 Cardiovascular
Health Summit

WHEN: April 3, 2008







WHERE: Holiday Inn Downtown at
the Park, Missoula MT

(For more information contact Gail
gailb@mt.net or call 406-442-4141)

Montana Diabetes Project Home Web Page

www.diabetes.mt.gov

What's available on the website?

-  “Children with Diabetes: A Resource Guide for Schools”
-  Cardiovascular Disease & Diabetes Surveillance Reports
-  Resource Library
-  Information on Acanthosis Nigricans
-  Information on **new** MT Cardiovascular Disease and Diabetes Prevention Program
-  NEW! “Burden of Diabetes in Montana”
(go to diabetes.mt.gov)

~Montana Diabetes Project (MDP) Staff~

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